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# **NAVAL POSTGRADUATE SCHOOL**

**MONTEREY, CALIFORNIA**

## **THESIS**

**ANALYSIS OF SWO FUNDAMENTALS EXAM SCORES**

by

Jason Michael Bradley

March 2011

Thesis Co-Advisors:

William Bowman  
Alice Crawford

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**ANALYSIS OF SWO FUNDAMENTALS EXAM SCORES**

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Submitted in partial fulfillment of the  
requirements for the degree of

**MASTER OF SCIENCE IN MANAGEMENT**

from the

**NAVAL POSTGRADUATE SCHOOL  
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## **ABSTRACT**

Since August 2008, the newly commissioned Surface Warfare Officer (SWO) has been trained for SWO qualification through the INTRO/ASAT program. Through this program, USNA and NROTC officers check onto their first ship and subsequently attend a five-week introductory course given by the Afloat Training Group (ATG) located in one of the Fleet Concentration Areas, and OCS officers attend the course in Newport, RI. Following this training, they report to their ship for on-the-job training (OJT). Computer-Based Training (CBT) discs are available to use as references. About 17 months following commissioning, the officer then reports to Surface Warfare Officer School (SWOS) for three weeks of Advanced Shiphandling and Tactics (ASAT) training. Upon arrival at ASAT, the officer is administered the SWO Fundamentals exam, designed to measure knowledge and retention of information covered during the OJT period. This thesis analyzes the SWO Fundamentals exam scores from 2007 to 2010 to determine which demographic and background variables affect a student's success and failure rates on the exam. Significant differences were found in gender, race, commissioning source, ship type, homeport, and class year.



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## **LIST OF ACRONYMS AND ABBREVIATIONS**

AMPHIB	Amphibious Type Ships
ASAT	Advanced Shiphandling and Tactics
ATG	Afloat Training Group
CBT	Computer Based Training
CG	Guided Missile Cruiser
CICWO	Combat Information Center Watch Officer
COI	Course of Instruction
COVE	Conning Officer Virtual Environment
CRUDES	Cruisers and Destroyers
DDG	Guided Missile Destroyer
FCA	Fleet Concentration Area
FFG	Guided Missile Frigates
INTRO	Introductory Course
MCM	Mine Countermeasures Ships
MW	Maritime Warfare
NROTC	Naval Reserve Officer Training Corps
OCS	Officer Candidate School
OJT	On-the-Job Training
OOD U/W	Officer of the Deck Underway
OOM	Order of Merit
OPTEMPO	Operational Tempo
ROR	Rules of the Road
SWO	Surface Warfare Officer
SWOS	Surface Warfare Officer School
SWOSDOC	Surface Warfare Officer School Division Officer Course
USNA	United States Naval Academy

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I would like to thank my advisors, professors Alice Crawford and William Bowman, for their wisdom, patience, guidance, and expertise.

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It has been a truly amazing experience to work with two such stalwart advocates for the SWO community.

It has been a profound pleasure to work with them and to know them.



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## **I. INTRODUCTION**

The Surface Warfare Officer (SWO) training pipeline has undergone several changes in the past decade. In 2003, the 16-week Surface Warfare Officer School Division Officer Course (SWOSDOC) program changed to Surface Warfare Officer School (SWOS)-at-Sea, which then changed in 2008 to the current INTRO/Advanced Ship-handling and Tactics (ASAT) program. Through each shift, there was a constant emphasis on training to the needs of the Navy by finding a balance between minimizing the length of training and time spent away from the fleet and maximizing the level of relevant information retained. This study will attempt to aid in the estimation of that balance for the current course of instruction (COI) by identifying which students are more likely to have difficulties meeting tested standards during the period between commissioning and ASAT.

### **A. BACKGROUND**

From 1970 to 2002, SWOS conducted SWOSDOC, a COI designed to imbue prospective SWO Division Officers with the requisite knowledge to begin working onboard Navy ships. This COI consisted of focused classroom instruction at SWOS in Newport, RI at the start of each officer's commissioned service, lasting six months at the start of the curriculum and shrinking to 16 weeks at its close. Following SWOSDOC, the officer went to their first ship for further training and SWO qualification. In 2003, SWOSDOC was dissolved and replaced with SWOS-at-Sea, an On-the-Job Training (OJT) program using Computer Based Training (CBT) reference and evaluation discs. In this COI, the officer reported directly to their ship following commissioning, and commenced duties as a Division Officer while learning the required SWO knowledge from mentors and CBT discs. At approximately 16 months, after completing the CBT discs, attaining the required SWO pre-requisite qualifications (to include Combat Information Center Watch Officer and Officer of the Deck Underway) and upon their Commanding Officer's recommendation, the student then attended a month of leveling instruction at ASAT in SWOS.

In August 2008, the Surface Warfare community shifted from the SWOS-at-Sea program to a hybrid approach between the division officer COI and the OJT method, INTRO/ASAT. This new approach consists of a five-week SWOS Introduction course, which takes place in the officer's Fleet Concentration Areas (FCAs) for USNA and NROTC commissioned officers and in Newport, RI for OCS commissioned officers. Following INTRO, they report to their ships for a 12–16 month on-the-job-training (OJT) period where they learn their trade and perform duties as Division Officers. Once each officer demonstrates an acceptable level of SWO knowledge, their respective Commanding Officers send them to the three-week ASAT course at Newport, RI for knowledge refinement and leveling. Once the student has completed the COI at ASAT, they return to their ship for further training and SWO qualification.

Since 2006, during the first two days of ASAT, SWOS instructors have administered the SWO Fundamentals exam, which measures the student's understanding of the requisite basic SWO knowledge attained during the period between commissioning and ASAT. This study analyzes the scores from the SWO Fundamentals exam from 2007-2010 and each student's demographic, professional and pre-commissioning attributes and will determine which attributes significantly impact the student's exam scores. The results of this analysis will highlight any particular subset of students having difficulties meeting tested standards within the training pipeline prior to reaching ASAT.

## **B. RESEARCH QUESTIONS**

The purpose of this study is to answer the following questions:

-How are a student's pre-commissioning factors, such as demographics, commissioning source, college quality, and major, related to their SWO Fundamental exam scores?

-How are a student's professional factors, such as homeport, ship type and department related to their SWO Fundamental exam scores?

-How are students in the INTRO/ASAT pipeline performing on the SWO Fundamental exam compared to students from the SWOS-at-Sea pipeline?

## **C. ORGANIZATION**

This thesis is organized into five chapters. This first chapter introduces the background and focus of the study. Chapter II provides further detail on the current SWO Training pipeline as well as all literature relevant to the current study. Chapter III describes the data used for this study and discusses the methodology of the analysis conducted. Chapter IV discusses the results of the analysis in detail. Finally, Chapter V summarizes this study, provides several conclusions based upon its results, and lists several recommendations based upon those conclusions.

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## **II. LITERATURE REVIEW**

### **A. CHAPTER OVERVIEW**

The purpose of this chapter is to provide a background for each Junior Officer Surface Warfare Officer (SWO) training curriculum, review previous analyses into the effectiveness of those curricula and review studies relevant to the variables used in previous SWO training evaluations. This chapter presents those studies as the foundation for the analysis and results of the present research.

### **B. BACKGROUND**

#### **1. SWOSDOC**

At its close in 2003, Surface Warfare Officers Division Officer Course (SWOSDOC) was delivered by traditional classroom instruction at Surface Warfare Officer School (SWOS) in Newport, RI. Having begun as a six-month course and eventually scaled down to 16 weeks, the course prepared newly commissioned officers to learn the fundamentals of shipboard life and operational requirements. Officers were sent on permanent change of station (PCS) orders from their respective commissioning source to Newport, and from there, to their first ship. Once on their ship, they would use the skills and knowledge they had attained at SWOSDOC as a starting point from which to work for and subsequently attain their SWO qualification.

#### **2. SWOS-AT-SEA**

SWOSDOC was questioned in the late 1990s from officers such as Lieutenant Commander Davis in 1997, and Lieutenant (Junior Grade) Poole in 1998, for failing to teach its students the knowledge actually required for shipboard performance, and for being a “program that is probably irretrievably broken” (Davis, 1997). They stated several concerns, namely that officers could never learn how to drive a ship by sitting in a classroom, and that they were not receiving adequate training on any other topic as the

instructors did not take the training seriously, teaching “hour-long classes in 20 minutes or less” (Poole, 1998). To answer concerns such as these, VADM LaFleur, then Commander, Naval Surface Force, charged that officers go directly to sea from their commissioning source, stating that the ship would provide the necessary subject-matter experts for the newly commissioned officers and would allow them to progress through their qualification pipeline more rapidly. Thus, in January 2003, the Navy adopted the SWOS-at-Sea program, where newly commissioned officers transitioned from their commissioning source to their first ship to receive approximately 16 months of on-the-job training (OJT) aided by a set of Computer Based Training (CBT) disks. They were expected to conduct their daily duties onboard and augment their learning with the CBT, which included a series of tests for each segment. Following attainment of Officer of the Deck Underway (OOD U/W) and upon their Commanding Officer’s (COs) approval, they would then travel Temporary Duty (TDY) to SWOS for three weeks of classroom-based knowledge refinement and leveling. Subsequently, they traveled back to their respective ships to study for and attain their SWO qualification.

### **3. INTRO/ASAT**

In a “Personal For” message to his Fleet Admirals, Admiral DC Curtis, then Commander, Naval Surface Force, said that he had received Fleet feedback stating that a “large percentage of our newly reporting Ensigns are not adequately prepared to function as an effective division officer/watchstander when they report onboard for their initial assignment” (ADM Curtis, in an e-mail sent to his Fleet Admirals on June 4, 2008). He further states, “Focusing on back to basics, I think the foundation of our success will be formed by providing our Officers with the basic education required to adequately perform their jobs on their road to becoming professional and effective Surface Warfare Officers.” The program he would charge to “bring back the basics” would be the INTRO course, which commenced in August 2008. Modeled after a three-week leveling course for Officer Candidate School (OCS) graduates currently held at SWOS, the INTRO program created for graduates of the United States Naval Academy (USNA) and Naval Reserve Officer Training Corps (NROTC) consists of three weeks of instructor-based classroom

and simulator instruction located in the students' respective Fleet Concentration Areas (FCAs). The Afloat Training Group personnel in each of these FCAs deliver the instruction. This three-week curriculum consists of 12 hours of Navy Familiarization, 23 hours of Division Officer Administration and Leadership, 22 hours of Navigation and Seamanship, 19 hours of bridge simulator, nine hours of Maritime Warfare, 16 hours of Engineering/Damage Control/Supply and two hours of CBT familiarization. Further, USNA and NROTC students receive a fourth week of leadership training and a fifth week of ship visit and qualification work. The goal of this combined training is to provide the new SWOs the tools needed to commence OJT with a sufficient level of comprehension to better understand and retain the information they are receiving.

Following this introductory course, all students return to their ship for OJT. The current version of SWOS-at-Sea CBT, v3.0, is formatted with a curriculum designed to complement OJT progression. Its course of instruction (COI) consists of the Personnel Qualification System (PQS) 100 Section (Fundamentals) and 200 Section (Systems) for all pre-requisite qualifications for the SWO PQS: Basic Damage Control, Maintenance and Material Management (3M) Division Officer, OOD Inport, SWO Engineering, Small Boat Officer, Combat Information Center (CIC) Watch Officer and OOD Underway. Also, it contains modules for Shiphandling, Weather, MOBOARDS, Division Officer Administration, Message Writing, Navigation, Rules of the Road, OOD Inport, Communications, Underway Fundamentals, Engineering, Combat Systems and Training/Readiness. All modules are incorporated with practicums, practical problems, assessments and case studies designed to help the student conceptualize the raw information received. These CBT modules are available for reference, but are no longer required unless an individual CO requires them.

At a time determined by the student's CO based on pre-requisite SWO PQS qualification completion, and OJT progression (typically about 17 months), they will report to SWOS for the three-week Advanced Ship-handling and Tactics (ASAT) course, which is similar to the three-week SWOSDOC leveling course previously given under the SWOS-at-Sea program. Once the students have completed their COI at ASAT, they return to their respective ships to study for and attain their SWO qualification.



The ASAT program consists of 13 hours of Administration and Testing, 18 hours of Conning Officer Virtual Environment (COVE), 23 hours of Bridge Resource Management (BRM) and Navigation, Seamanship, Shiphandling (NSS), 51 hours of Maritime Warfare (MW) and 10 hours of Leadership training. Throughout the training, the student will receive four tests: SWO Fundamentals, Rules of the Road (ROR), Navigation Fundamentals (NAV) and Maritime Warfare (MW). The SWO Fundamentals exam assesses knowledge gained during the period between commissioning and ASAT, and the ROR, NAV and MW exams assess knowledge gained during ASAT instruction. Every student must pass the SWO Fundamentals exam by 75 percent or higher, the ROR exam by 90 percent or higher, the Navigation Fundamentals Assessment by 75 percent or higher and the MW exam by 75 percent or higher. Officers who attain a minimum of 85 percent on the SWO Fundamentals exam, a minimum of 96 percent on the ROR exam and a minimum of 85 percent on the MW exam are given Honor Graduate status; Honor Graduates receive a “tie-breaker” in second tour Division Officer slating boards.

### **C. TRAINING REFINEMENT**

In an effort to adjust and overhaul entire training programs, there are many opportunities to overlook areas that are critical to training success. The following three studies discuss those areas for each training program and determine which areas require focus in future iterations.

#### **1. SWOSDOC**

Vaas (2004), in his study of the overall effectiveness of the Surface Warfare Officer Division Officers Course (SWOSDOC), analyzed a sample of 3023 students ranging from years 1994 to 2000 to determine the learning differentials among students and discuss possible difficulties with shifting from instructor-led SWOSDOC to self-paced CBT. By dividing the test scores into specific training modules and conducting a univariate analysis, he found that all accession sources were equally providing officers with the leveling required to perform at similar paces. However, he also found that minorities, non-technical undergrad students, USNA graduates, and females did not

perform as well as others on the SWOSDOC tests. These results showed that, while accession sources allow for minimal self-paced instruction concerns, it was dangerous to count on a CBT program to adequately train minorities, females, and non-technical undergrad students.

This study's results, particularly those highlighting the impacts of accession sources, gender and ethnicity will inform the analysis of the present thesis as it attempts to find and evaluate the specific hindrances to SWO education under the current curriculum.

## **2. SWOS-at-Sea**

In "An Assessment of the Effectiveness of Computer-based Training for Newly Commissioned Surface Warfare Division Officers," Bowman, Crawford, and Mehay (2009) discussed the overall effectiveness of the training program since the dissolution of SWOSDOC. In six interviews with post-command Captains, they found an overall lack of standardization across the board for training implementation, an increasing shortage of knowledge in their Division Officers, a decreased perception of the value of SWO training among officers and a lack of shipboard mentorship amongst wardroom members. In interviews with 17 SWO CBT trainees, they found the following results: there was not enough time to complete the CBT, in addition to their normal duties; the students did not find CBT engaging or interesting enough to look at when they did have time; there were no training modules for interacting with and leading subordinates; and finally, USNA graduates are better prepared for shipboard life than OCS or NROTC graduates, resulting in a knowledge gap for application of the CBT modules. As a result of this feedback, the researchers recommended a standardization of the entry training for SWOs to account for the observed deficiencies of computer-based training.

For their statistical analysis, Bowman, Crawford, and Mehay (2009) conducted a multivariate regression for all exams (Maritime Warfare, Navigation, Seamanship, SWO Fundamentals and Rules of the Road). The goal of this analysis was to determine what factors among demographics, military background and education background had an impact upon the knowledge level of students at SWOS. They found that females, officers

assigned to non-CRUEDES ships, those assigned to ships out of Norfolk and USNA graduates did not perform as well as others on the SWO Fundamentals exam taken at the beginning of the ASAT COI. Conversely, there were no significant results regarding any gender inequity for the Maritime Warfare and Rules of the Road exams taken at the end of the COI following specific classroom instruction.

In conclusion, Bowman, Crawford, and Mehay (2009) determined that further analysis needed to be conducted to determine the nature of the test-score differentials. This thesis compares these results to the current training program with a similar quantitative analysis.

### **3. INTRO/ASAT**

In “Process Evaluation of SWOS Division Officer Training,” Crawford and Stoker (2010) sought to examine the efficacy of the new INTRO/ASAT Training program. To assess the newly formed program, they conducted a formative evaluation including an interview process covering a sample of each stakeholder group. In evaluating the INTRO course, they interviewed 110 officers, including those who had previously attended the new course, post-command and post-department head tour officers, Afloat Training Group (ATG) instructors, SWOS leadership and those currently attending the ASAT course. Through the interviews, the researchers found that, with regard to INTRO, most students were happy with the opportunity to network with fellow Junior Officers outside of their respective wardrooms, and that they enjoyed the week of hands-on training at the close of the course. However, they also found the following concerns:

1. ATG is currently undermanned and is having difficulty fulfilling its many training missions, while also dedicating instructors to the INTRO course.
2. The students feel as if they are receiving an inordinate amount of information in a short period, hampering the overall level of knowledge attained.

3. Students coming from USNA have already received most of the Division Officer Fundamentals information prior to graduating, and so are bored and disinterested when receiving the same information at INTRO.

4. If a student has been on a ship for a longer period of time prior to reporting to INTRO, the information will already be known and will therefore be a waste of time.

5. Senior Officers interviewed stated that there wasn't enough focus placed on actual practical knowledge such as Material Maintenance Management (3M), standard commands, communications procedures and MOBOARDS, which they felt are the training material that forms the basis of SWO knowledge and thus consumes the bulk of the student's OJT time.

To assess the ASAT course, Crawford and Stoker (2010) interviewed 30 ensigns from an ASAT class. Interviewees expressed generally positive impressions of the course, with the primary challenge noted being the extreme ranges of knowledge among the students when they arrive.

For their quantitative analysis, Crawford and Stoker analyzed the test scores of all ASAT classes for 2009. As the sample size is small, the results are not conclusive; however, as it spans both the old and the new program, it does serve to highlight potential trends in training deficiencies and provide focus for future training. In an analysis using scores from the test battery as the dependent variables and student demographics and background as independent variables, they determined that students who underwent the new curriculum received lower test scores than those from the old curriculum. Also, they found that women did not perform as well as men when tested for knowledge covered during their OJT period but perform at the same level when tested for knowledge covered during ASAT. Further, minorities were shown to perform lower on the ASAT test scores, but qualify sooner than Whites.

These results show that there are several problem areas in the SWO training process, areas that need further research as a part of a similar analysis over a longer period. The present study will provide such analysis.

Overall, Crawford and Stoker (2010) determined that the INTRO/ASAT curriculum satisfactorily answers the need for initial familiarization and socialization; however, the Navy will need to address the deficiencies found by the study (such as ATG's manning concerns) in the near future in order to maintain surface training sustainability. While addressing those deficiencies, the curriculum should be further adjusted to compensate for the noted training shortfalls in minorities and females, along with any other potential problem areas. This thesis takes the known shortfalls from Crawford and Stoker's quantitative analysis, evaluates them with a larger sample, and looks for all other differentials related to test failure and honor graduate performance in order to provide a complete picture for evaluating potential curriculum adjustments.

#### **D. TEST SCORE DIFFERENTIALS**

To effectively adjust a program's training curriculum, the influencing factors behind the differentials affecting training must be completely understood. To facilitate this further understanding, the following studies provide perspective relating to each potential influencing factor, and inform the results of this study of the current training curriculum.

##### **1. Demographics**

###### ***a. Gender***

As noted in Bowman, Crawford, and Mehay (2009) and Crawford and Stoker (2010), female SWOs do not perform as well as males when tested for knowledge covered during OJT/CBT periods. Many studies have addressed the differences in gender performance in the classroom environment, but are out of the scope of this thesis. Any gender performance concerns raised by this analysis will be addressed in the recommendations portion of this study.

***b. Ethnicity***

As noted in Crawford and Stoker (2010), minority officers do not score as highly on the SWO Fundamentals exam as white officers. As with gender, there have been many studies that address the minority performance gap in education environments; however, also as with gender, these issues are out of the scope of this thesis. Any ethnicity performance concerns raised by this analysis will be addressed in the recommendations portion of this study.

**2. Homeport**

Bowman, Crawford, and Mehay (2009) analyzed the effects of homeports on the student performance on the SWO Fundamentals exam by grouping the sample into four categories: Western Pacific, Japan, Atlantic Coast and Other. They found that those who were stationed on ships out of the Western Pacific, Japan and Other bases were 7.8 percent, 12.6 percent and 32 percent, respectively, more likely to pass this test than those stationed on ships on the Atlantic Coast. As a result of the model and controlled factors, possible reasons for the differences exclude ship type, self-selection from commissioning source or undergraduate institution quality or demographic differences. As the analysis from the tests that measure knowledge gained under instruction at ASAT/SWOSDOC indicates, there are no significant differences among the students based upon homeport. The researchers suggest that possible reasoning for the differences in initial testing lies in some unknown factor related specifically to the students' respective homeport itself.

For the present research, the sample will be distributed to break out the results for the "Other" category in order to have a better understanding of the results. As the Atlantic Coast bases are shown here to have a negative impact on student knowledge attainment and retention prior to attendance at ASAT/SWOSDOC, the present research will determine whether Norfolk or Mayport plays a predominant role in these results.

In "You Only Get One Chance to Make a First Impression: A Quantitative Analysis of Division Officer Fleet Experiences on Surface Warfare Officer Retention," Roy (2007) conducted a non-linear logistic regression on 3,206 SWOs in order to

determine the major causal factors in the “stay or go” decision. His findings indicated that those officers initially assigned to ships stationed in the Norfolk/Little Creek areas were more likely to choose to stay in the Navy. Roy suggested several possible reasons for this result, for example, the financial and residency stability of the region attracts a more grounded and long-term minded officer, one who would be more likely to stay in the Navy anyway. Another explanation Roy suggested is that the more popular homeports, such as those on the West Coast, are taken by the more academically successful students; therefore, those left to choose Norfolk are those without as many external options for employment.

According to Roy’s results, an officer’s decision to choose Norfolk as an initial homeport could be due either to his desire to perform well as an officer, or to his inability to perform during undergraduate school. As such, the choice of Norfolk could be either a positive or negative indicator of his ability to learn the required material for SWO qualification.

### **3. Ship Type**

Bowman, Crawford, and Mehay (2009) divided their sample of 551 SWOs at ASAT/SWOSDOC into four groups: Destroyers, Cruisers and Frigates, Amphibious ships and Other. They found that officers assigned to Destroyers are more likely to pass the tests taken during the initial phase of ASAT/SWOSDOC, which measure self-directed study, namely the SWO Fundamentals exam, than those assigned to either Frigates or Amphibious ships. Most strikingly, they found that those assigned to Cruisers and Destroyers (CRUDES) had a 20 to 30 percent higher passing rate than those assigned to Amphibious ships (AMPHIBS). The researchers suggest that one possible reason for the difference in test scores is that officers on AMPHIBS have a lower level of personal motivation as their respective chains of commands include many officers from non-surface warfare communities. They pose that this factor could mean that AMPHIB officers experience less pressure to complete the CBT COI.

Studying the difference in impact on SWO retention between the various ship types, Bautista (1996) in “Surface Warfare Junior Officer Separation: Does Ship Type

Make a Difference?” found that with a sample of 8260 officers ranging from years 1976 to 1990, officers on CRUDES platforms were more likely to attain SWO qualification earlier than officers on AMPHIBS. Specifically, he found that Division Officers on CRUDES had a more conducive environment for SWO qualification attainment and that Division Officers on AMPHIBS had a decreased likelihood of qualification regardless of undergraduate GPA. These results support Bellamy (1991), who conducted a similar analysis on SWOs past their initial minimum service requirements. Bellamy looked at the relationship between initial assignment, qualification and performance and found that certain ship classes, namely CRUDES ships, contribute to higher Junior Officer performance potential and faster qualification. His conclusion states that CRUDES ships indeed offer the greatest opportunity for SWO qualification.

These findings, namely that CRUDES platforms are more conducive to SWO qualification, and that officers on CRUDES platforms perform better on the SWO Fundamentals exam, will be used to determine the structure of the regression model for the present study and will be compared with its results for a more robust understanding of the effects of initial ship selection on SWO qualification.

#### **4. School Quality**

In an effort to determine the impact of the quality of an officer’s undergraduate education on their performance, Bowman and Mehay (2002), in “College Quality and Employee Job Performance: Evidence from Naval Officers,” conducted a study that included a sample of Naval Officers from over 1000 undergraduate sources. Of this sample, Bowman and Mehay looked for the Fitness Report inclusion of the phrase “recommended for accelerated promotion” for those officers who had served less than 10 years, and for promotion to LCDR for those who had served more than 10 years. Taking these categories, they conducted a logit regression, using Barron’s educational institution classifications of Most Competitive, Highly Competitive, Competitive and Least Competitive and, controlling for GPA and major, found that graduates of Most Competitive and Highly Competitive institutions demonstrated a greater propensity to be “recommended for accelerated promotion” than their colleagues. The researchers also



found that a technical degree was not necessary for success. Finally, they found that those with higher GPAs were indeed more likely to attain higher rank. These results indicate most predominantly that the undergraduate source plays a role in the officer's performance, with those who graduate from higher competitive institutions performing significantly better than their colleagues.

Bowman, Crawford, and Mehay (2009) found surprisingly different results than were expected based on Bowman and Mehay (2002). Of the sample of 372 officers, when compared with those from Mostly Competitive schools, only those from the Highly Competitive and Least Competitive schools were less likely to pass the CBT-measuring tests at ASAT/SWOSDOC. Of the tests taken at the end of SWOS, however, there were no statistically significant predictors, indicating that the undergraduate school quality measurements may not be adequate measures of a student's cognitive skills.

As the sample size for Bowman, Crawford, and Mehay (2009) is relatively small, the present study will apply the same measurement variables over a larger sample, expecting results as predicted from Bowman and Mehay (2002), that those students from higher competitive undergraduate institutions will perform better than those from lower competitive undergraduate institutions.

## **5. Undergraduate Majors**

In "College Quality and Employee Job Performance: Evidence from Naval Officers," along with their results for college quality, Bowman and Mehay (2002) found that a technical undergraduate degree was not necessary for attainment of higher job performance marks. They attributed this finding to job performance being a qualitative measurement tied more to interpersonal and social skills rather than to math and science skills. However, Bowman, Crawford, and Mehay (2009) found the opposite for undergraduate degrees as they pertain specifically to CBT. For their analysis, they categorized their sample into six major groups: engineering, math/physical sciences, biological sciences, business/economics, social sciences and arts and humanities; they found that those with technical majors outperformed all others on the SWO Fundamentals exam.

## **6. Commissioning Source**

In the three studies evaluating SWO training pipeline effectiveness, there have been three different results for the impact of accession points.

Vaas (2004) found that the student's accession point bears little impact on leveling performance at SWOSDOC. However, on the initial tests, USNA graduates typically do not perform as well as others. One possible reason for this, as discussed later by Crawford and Stoker (2010), is that there is less motivation to initially perform well in a military education environment after leaving such a similar strenuous experience as the Naval Academy.

Bowman, Crawford, and Mehay (2009) determined that USNA graduates were better prepared to meet the dual challenges of shipboard duties and CBT requirements. They determined that SWOs who had graduated from USNA were acclimated to time-restricted situations and would be more disciplined regarding self-instruction.

Finally, Crawford and Stoker (2010) found that USNA students did not perform as well as NROTC and OCS graduates in the new INTRO curriculum. One possible reason for the poor USNA performance at ASAT, as determined through the qualitative portion of Crawford and Stoker's study, was that USNA graduates were less inclined towards the training, as they had already received similar instruction prior to commissioning, and that the graduates from the other two sources were perhaps hungrier for professional engagement, as they had received minimal such exposure prior to commissioning.

The conclusions from these three studies show that there is an initial disadvantage to USNA graduates during the preliminary testing period, potentially due to the student having recently experienced advanced academic rigors that have affected his or her present motivation; however, this disadvantage has the potential to diminish throughout the training period.

## **E. CONCLUSION**

The curriculum and process for training SWOs has undergone several major upheavals during the past decade. Throughout each change, the Navy has sought to directly answer the deficiencies of the previous program. As there are many forces influencing the nature of knowledge attainment and retention for SWOs, it is important that the impact of each be understood and accounted for when making adjustments to the training curriculum; failure to do so would cause further upheaval and unneeded implementation and adjustment costs.

### **III. METHODOLOGY**

#### **A. INTRODUCTION**

While the previous chapter provided the framework for the present study by discussing precedent studies and their relevance, this chapter discusses how that framework shapes the foundation for the analysis.

#### **B. DATA**

This study utilized Surface Warfare Officer School (SWOS) data containing student test scores, demographics, education and professional background from the SWO Fundamentals exam taken at the initial phase of ASAT/SWOSDOC during the period 2007–2010. In August 2008, SWOS-at-Sea transitioned to INTRO/ASAT, and the first class at ASAT under the new curriculum arrived 17 months after that, on average. The SWO Fundamentals exam is given during the initial stage of ASAT and is designed to test the student's knowledge gained during the period between commissioning and ASAT; it consists of four separate modules: Division Officer Fundamentals, Maritime Warfare, Rules of the Road and Engineering. This study will analyze the provided scores and student information for the SWO Fundamentals exam.

#### **C. VARIABLES**

The literature review shows that any SWO training analysis should include the following variables: gender, ethnicity, commissioning source, undergraduate major, undergraduate institution quality, homeport, and ship type. In order to show the effects of either CBT or INTRO/ASAT on the student's test scores, the model will also include a variable for both types of curricula. Table 1 outlines the proposed independent variables, and the percentage of each represented in the data set.

Table 1. Variable Distribution\*

Dependent variables	Percentage of Sample
Failure	22.59
HGE	39.77
Independent Variables	
Gender	
Male	75.12
Female	24.88
Ethnicity	
White	75.27
Black	8.12
Hispanic	4.79
Asian	5.93
Native American	0.57
Other	2.76
Undergraduate School Quality	
Most Competitive	7.91
Highly Competitive	13.53
Very Competitive	17.28
Competitive	14.57
Least Competitive	6.66
Undergraduate Major	
Engineering	18.12
Math/Science	13.95
Biological Science	8.43
Economics/Business	16.45
Social Sciences	31.70
Humanities	8.64
Other	1.41
Commissioning Source	
USNA	39.88
NROTC	40.92
OCS	19.26
Homeport	
Norfolk	29.88
San Diego	31.91
Everett	2.92
Mayport	11.19
Pearl Harbor	8.22
Sasebo/Little Creek	7.13
Ingleside/Pascagoula	1.98
Yokosuka	6.66
Ship Type	
DDG	38.05
CG	17.23
FFG	16.66
AMPHIB	25.35
MCM	2.76
Department	
Combat Systems	35.03
Engineering	28.79
Operations	31.96
Nav/Admin	3.28
Class Year	
2007	14.32
2008	27.23
2009	36.59
2010	21.92
<b>Number of Observations</b>	<b>1856</b>

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\* Each variable group individually accounts for 100 percent of the sample, with the exception of Undergraduate School Quality, as USNA accounts for 39.88 percent as a Most Competitive institution.

## **1. Dependent Variables**

For this analysis, the SWO Fundamentals exam scores have been recoded into two separate dichotomous variables: Failure and Honor Graduate Eligibility (HGE).

### ***a. Failure***

In order to pass the SWO Fundamentals exam, a student is required to score 75 percent or above. For the sample, 434 (22.59 percent) officers scored below 75 percent on the exam. The Failure variable is dichotomous where one represents any score less than 75 percent.

### ***b. Honor Graduate Eligibility***

During the ASAT phase, officers who attain a minimum of 85 percent on the SWO Fundamentals exam, a minimum of 96 percent on the ROR exam and a minimum of 85 percent on the MW exam are given Honor Graduate status. As such, for this study, the HGE variable will equal one for students who score 85 percent or above, representing Honor Graduate eligibility.

## **2. Independent Variables**

### ***a. Gender***

The gender variable in the data set is dichotomous, where male = 0 and female = 1. Given the significant results from test-score analysis in Bowman, Crawford, and Mehay (2009), and Crawford and Stoker (2010), which suggested that females perform statistically lower on tests administered during the initial phase of SWOS/ASAT, the predicted influence of this variable on the propensity for failure will be significant, and positive and the influence on the propensity for success will be significant and negative.

***b. Ethnicity***

As Crawford and Stoker (2010) show that minorities score lower on the SWO Fundamentals exam at ASAT/SWOSDOC, the White variable will be the reference variable for both the Failure model and the HGE model. In accordance with this study, the results from the present research are expected to show higher test scores for White officers as compared to those in other ethnic groups.

***c. Undergraduate School Quality***

The Barrons Selectivity Index classifies undergraduate institutions in one of five categories: Most Competitive, Highly Competitive, Very Competitive, Competitive, and Least Competitive. As shown in Bowman and Mehay (2002) and Bowman, Crawford, and Mehay (2009), any analysis of officer performance after commissioning should include a variable for undergraduate school quality using the Barrons classification method. As Bowman and Mehay (2002) found that those graduates from Barrons Most Competitive institutions were most likely to exhibit a high level of performance in the fleet, the present study expects similar results for the SWO Fundamentals exam.

***d. Undergraduate Major***

Bowman, Crawford, and Mehay (2009) showed that an officer's undergraduate major becomes significant when determining performance on the SWO Fundamentals exam; specifically they found that those with technical degrees outperformed all others. Given these results, Engineering Major is the reference variable for both models in the present analysis, and the expected result is that those with any other major will be more likely to score below 75 percent and less likely to score 85 percent or higher on the SWO Fundamentals exam.

***e. Commissioning Source***

Crawford and Stoker (2010) suggested that USNA graduates were more likely to score lower on the SWO Fundamentals exam than were NROTC or OCS

graduates. One possible reason for these results was that the USNA graduates were more anxious for the practical side of their profession and less motivated to complete academic work, as the previous four years had been filled with military-based training and schoolwork. However, Bowman, Crawford, and Mehay (2009) concluded that USNA graduates should perform better than their counterparts as they had been exposed to more complex and demanding time-management scenarios and were more accustomed to the types of military rigors they would experience as Junior Officers.

In line with Bowman, Crawford, and Mehay (2009), and contrary to Crawford and Stoker (2010), this study uses USNA as the reference variable for commissioning source. This decision is in part due to the reasoning Bowman, Crawford, and Mehay (2009) put forth regarding USNA graduates' being accustomed to time management and military rigors, and in part because this study will suppose that NROTC graduates are equally adverse to further study and as excited for practical learning as USNA graduates. Also, as discussed for the Undergraduate Major variables, and found in Bowman, Crawford, and Mehay (2009), those with technical majors are more likely to succeed on the SWO Fundamentals exam. As USNA has a heavy engineering core curriculum, USNA graduates should reasonably score higher than any non-USNA graduate with a non-technical degree.

As USNA and NROTC officers are expected to experience a similar lack of motivation towards academic work and USNA officers are expected to be better trained in time-management, military demands, the rigors of study and more inclined towards technical subjects, it is expected that USNA officers will outperform all others. Therefore, this study anticipates that USNA graduates will be less likely to score less than 75 percent and more likely to score 85 percent or higher on the SWO Fundamentals exam than both NROTC and OCS graduates.

*f.       Homeport*

Little Creek and Sasebo were combined, due to both ports being exclusively amphibious. The expectation is that the coefficient from this variable will tell us the impact of being stationed in a primarily amphibious base, on an officer's



performance on the SWO Fundamentals exam. Officers serving out of Ingleside and Pascagoula were combined more for their specific location in the US than for mission or ship type. Roy (2007) found that officers serving out of Ingleside, Pascagoula and Mayport were less likely to stay SWO. As he had controlled for ship type in each port, he concluded that the determinant for the officers' decisions to leave the SWO community was tied specifically to some unknown common factor in those three ports. However, in contrast to Roy (2007), this study separates Mayport in order to account for any variability and/or determinant from the presence of CRUDES ships and FFGs in Mayport.

Norfolk is the reference variable for this group. Bowman, Crawford, and Mehay (2009) state that officers who choose ships on the Atlantic coast do not perform as well on the SWO Fundamentals exam compared to other officers. However, Roy (2007) concludes that officers out of Norfolk are more likely to stay in the Navy than any other officer, where officers out of Mayport, Pascagoula and Ingleside were less likely to do so. Due to the combination of Mayport and Norfolk by Bowman, Crawford, and Mehay (2009) and the combination of Mayport, Pascagoula and Ingleside by Roy (2007), and due to the opposing nature of the results for both studies, this study will hold Norfolk as the reference variable and test the impact of every other port on the SWO Fundamentals exam in comparison. The present study expects to find in accordance with Bowman, Crawford, and Mehay (2009) that officers serving in Norfolk will be less likely to score 85 percent or above and more likely to score 75 percent or below.

*g. Ship Type*

For the present study, DDG is the reference variable for both models, as Bowman, Crawford, and Mehay (2009) found that officers assigned to DDGs were more likely to outperform all others. Similarly, Bautista (1996) and Bellamy (1991) both found that officers on CRUDES platforms were more likely to attain SWO qualification earlier than their AMPHIB counterparts. As such, the present study expects officers serving on DDGs to be more likely to score 85 percent or higher and less likely to score less than 75 percent on the SWO Fundamentals exam.

*h. Department*

For the present study, the Combat Systems variable was chosen over Operations, Engineering, and Navigation/Admin as the reference variable for both models due to having the largest representation in the sample.

*i. Class Year*

As discussed in the preceding chapter, the current SWO training program came into effect in August 2008. As the average length of time between commissioning and ASAT for this sample is 17 months, the first class to ASAT under the INTRO/ASAT program arrived in January 2010. Therefore, this model will use 2009 as the reference variable, in order to compare SWO Fundamentals exam scores for SWOS-at-Sea vs. INTRO/ASAT.

**D. METHODOLOGY**

Non-linear logistic regression analysis was used to determine the influence of the reference and independent variables. In order to determine which factors individually affect both the likelihood of a student to fail and the likelihood of a student to attain ASAT Honor Graduate eligibility on the SWO Fundamentals exam, this study uses two separate models using each scenario as a single dependent variable. One model, using HGE as the dependent variable, will demonstrate the effect each variable has on a student's likelihood to score an 85 percent or above; and the other, using Fail as the dependent variable, will demonstrate the effect each variable has on a student's likelihood to score below 75 percent.

**E. SUMMARY**

This chapter described the variables chosen to analyze the relationship between an officer's professional and personal background, and their potential of scoring either below a 75 percent or above an 85 percent on the SWO Fundamentals exam.

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## **IV. RESULTS AND ANALYSIS**

Previous chapters discussed several studies regarding SWOSDOC and ASAT testing as well as the current study's variables and method of analysis. This chapter discusses the results of the regression analysis described in the preceding chapter to ascertain determinants of a student's propensity to either fail the SWO Fundamentals exam by scoring below 75 percent or to attain an Honor Graduate eligible score by scoring 85 percent or above. The aim of the analysis is to provide an understanding of the influence a newly commissioned Surface Warfare Officer's environment and background have on their ability to learn and retain new information. This chapter will first provide a brief overview of each model, followed by a comprehensive discussion of both.

### **A. FAILURE REGRESSION RESULTS**

As previously discussed, this study covers data from both the current and previous training curricula. Previously, the SWO Fundamentals exam was given upon a student's arrival to ASAT/SWOSDOC and covered information attained during OJT and CBT. In the current curriculum, the SWO Fundamentals exam measures the knowledge gained during the INTRO course of instruction after commissioning and through approximately 16 months of shipboard training. Every student is required to score a minimum of 75 percent on the test, and is given one retake should they fail. If they fail the retake, they are given a course completion letter in lieu of a graduation certificate and are to be reassessed by their Commanding Officer and retested by their ship's Immediate Superior in Command (ISIC) prior to their SWO qualification board.

As mentioned in the preceding chapter, the Failure variable is dichotomous, where 1 = 74 percent or below on the SWO Fundamentals exam and 0 = 75 percent or above. Further, this model uses only the first attempt at taking the exam, omitting any retakes, as this study is not analyzing the effectiveness of the training environment at

ASAT. As all independent variables are also dichotomous, the results for each variable will be interpreted as percentage points compared with their respective reference variable. Table 2 provides the results of the Failure Model regression.

Table 2. Failure Model Regression Results

No Obs = 1856 Pseudo R2 = .1265 Log Likelihood = -860.455	Probit Coefficient	Marginal Effects	Standard Error	P-Value
Gender:				
<b>Female</b>	<b>.2511</b>	<b>.0724</b>	<b>.0828</b>	<b>.002</b>
Ethnicity:				
<b>Black</b>	<b>.5482</b>	<b>.1769</b>	<b>.1189</b>	<b>.000</b>
Hispanic	.0697	.0195	.1584	.660
Asian	.2065	.0609	.1423	.147
<b>Native American</b>	<b>.7566</b>	<b>.2624</b>	<b>.3892</b>	<b>.052</b>
Other	.1609	.0469	.2010	.423
School Quality:				
Barrons HC	-.0491	-.0132	.1561	.753
Barrons VC	-.1237	-.0327	.1529	.418
Barrons C	.0911	.0256	.1585	.565
<b>Barrons LC</b>	<b>.4619</b>	<b>.1467</b>	<b>.1830</b>	<b>.012</b>
Undergraduate Major				
Math/Science	.1015	.0286	.1309	.438
Biological Science	.2304	.0681	.1503	.125
<b>Economics/Business</b>	<b>.4610</b>	<b>.1420</b>	<b>.1198</b>	<b>.000</b>
<b>Social Sciences</b>	<b>.4230</b>	<b>.1233</b>	<b>.1069</b>	<b>.000</b>
<b>Humanities</b>	<b>.3663</b>	<b>.1127</b>	<b>.1439</b>	<b>.011</b>
Other	.2056	.0610	.3134	.512
Commissioning Source:				
NROTC	-.0222	-.0061	.1390	.873
OCS	-.0056	-.0015	.1669	.973
Homeport:				
<b>Everett</b>	<b>-.5492</b>	<b>-.1164</b>	<b>.2755</b>	<b>.046</b>
Ingleside/Pascagoula	-.1634	-.0417	.3139	.603
Little Creek/Sasebo	.0437	.0122	.1477	.767
Mayport	-.1521	-.0395	.1333	.254
Pearl Harbor	-.1178	-.0309	.1418	.406
<b>San Diego</b>	<b>-.2525</b>	<b>-.0663</b>	<b>.0902</b>	<b>.005</b>
Yokosuka	-.1298	-.0338	.1543	.400
Ship Type:				
<b>FFG</b>	<b>.1988</b>	<b>.0575</b>	<b>.1134</b>	<b>.080</b>
CG	.0635	.0177	.1056	.548
<b>AMPHIB</b>	<b>.2502</b>	<b>.0721</b>	<b>.1047</b>	<b>.017</b>
<b>MCM</b>	<b>.6286</b>	<b>.2107</b>	<b>.2772</b>	<b>.023</b>
Department:				
Engineering	.1218	.0341	.0916	.184
Nav/Admin	.2139	.0635	.1966	.277
Operations	.0342	.0094	.0924	.711
Class Year:				
<b>2007</b>	<b>1.204</b>	<b>.4159</b>	<b>.1059</b>	<b>.000</b>
<b>2008</b>	<b>.4983</b>	<b>.1489</b>	<b>.0937</b>	<b>.000</b>
<b>2010</b>	<b>.5958</b>	<b>.1850</b>	<b>.0984</b>	<b>.000</b>

As the results in Table 2 show, there are few surprises in this regression as compared with the results from preceding studies. Females and Blacks continue to show a propensity to fail when compared to males and Whites. Graduates from the lowest rated institutes are more likely to fail, than those from the highest rated institutions. Officers initially assigned to Amphibious ships, and MCMs, continue to have a greater propensity to fail than those assigned to DDGs. Students taking the test in 2009 had steadily improved since 2007. One interesting result was that students taking the exam in 2010 were 18.5 percent more likely to fail than students in 2009. Also interesting, Economics/Business, Social Sciences, and Humanities majors were significantly more likely to fail than Engineering majors; however, Biological Sciences and Math/Science majors were not. Finally of note, officers assigned to ships out of Everett and San Diego are about 12 percent and seven percent respectively less likely to fail than those assigned to ships out of Norfolk; all other ports are non-significant as compared to Norfolk.

## **B. HONOR GRADUATE REGRESSION RESULTS**

As discussed in previous chapters, Honor Graduate status is given to any student who scores 85 percent or above on the SWO Fundamentals exam, 85 percent or above on the Maritime Warfare exam and 96 percent or above on the Rules of the Road exam. As such, this study will use a score of 85 percent on the SWO Fundamentals exam as the measure for the HGE Regression, representing overall Honor Graduate eligibility. The HGE variable is dichotomous, where 1 = 85 percent or above on the SWO Fundamentals exam and 0 = 84 percent or below. As in the Failure model, this model uses only scores from the student's first attempt at taking the exam. As all independent variables are also dichotomous, the results for each variable will be interpreted as percentage points compared with its respective reference variable. Table 3 provides the results of the Honor Graduate Eligibility Regression.

Table 3. Honor Graduate Eligibility Model Regression Results

No. Obs = 1856 Pseudo R2 = .1054 Log Likelihood = -1118.001	Probit Coefficient	Marginal Effects	Standard Error	P-Value
Gender:				
<b>Female</b>	<b>-.1730</b>	<b>-.0653</b>	<b>.0755</b>	<b>.022</b>
Ethnicity:				
<b>Black</b>	<b>-.3396</b>	<b>-.1231</b>	<b>.1225</b>	<b>.006</b>
Hispanic	-.2366	-.0872	.1471	.108
Asian	-.1049	-.0396	.1295	.418
Native American	-.4908	-.1690	.4466	.272
Other	-.3142	-.1137	.1964	.110
School Quality:				
Barrons HC	-.1273	-.0480	.1356	.348
Barrons VC	-.1683	-.0633	.1306	.198
<b>Barrons C</b>	<b>-.5223</b>	<b>-.1849</b>	<b>.1401</b>	<b>.000</b>
<b>Barrons LC</b>	<b>-.5634</b>	<b>-.1934</b>	<b>.1733</b>	<b>.001</b>
Undergraduate Major:				
Math/Science	-.0559	-.0213	.1079	.605
<b>Biological Science</b>	<b>-.2788</b>	<b>-.1023</b>	<b>.1296</b>	<b>.031</b>
<b>Economics/Business</b>	<b>-.2439</b>	<b>-.0907</b>	<b>.1037</b>	<b>.019</b>
<b>Social Sciences</b>	<b>-.3811</b>	<b>-.1419</b>	<b>.0900</b>	<b>.000</b>
Humanities	-.1386	-.0521	.1265	.273
Other	-.1967	-.0729	.2772	.478
Commissioning Source:				
<b>NROTC</b>	<b>.4097</b>	<b>.1573</b>	<b>.1211</b>	<b>.001</b>
OCS	.1477	.0572	.1437	.304
Homeport:				
<b>Everett</b>	<b>.6417</b>	<b>.2517</b>	<b>.1981</b>	<b>.001</b>
Ingleside/Pascagoula	.0201	.0077	.3107	.948
Little Creek/Sasebo	.1479	.0575	.1472	.315
<b>Mayport</b>	<b>.3834</b>	<b>.1506</b>	<b>.1175</b>	<b>.001</b>
<b>Pearl Harbor</b>	<b>.5137</b>	<b>.2022</b>	<b>.1245</b>	<b>.000</b>
<b>San Diego</b>	<b>.4306</b>	<b>.1669</b>	<b>.0806</b>	<b>.000</b>
<b>Yokosuka</b>	<b>.4687</b>	<b>.1846</b>	<b>.1320</b>	<b>.000</b>
Ship Type:				
<b>FFG</b>	<b>-.2809</b>	<b>-.1040</b>	<b>.0976</b>	<b>.004</b>
<b>CG</b>	<b>-.2488</b>	<b>-.0925</b>	<b>.0917</b>	<b>.007</b>
<b>AMPHIB</b>	<b>-.2224</b>	<b>-.0835</b>	<b>.0959</b>	<b>.020</b>
<b>MCM</b>	<b>-.4726</b>	<b>-.1644</b>	<b>.2704</b>	<b>.080</b>
Department:				
Engineering	-.0531	-.0203	.0806	.510
Nav/Admin	-.1995	-.0739	.1884	.290
Operations	-.0650	-.0248	.0807	.420
Class Year:				
<b>2007</b>	<b>-.9679</b>	<b>-.3089</b>	<b>.1046</b>	<b>.000</b>
<b>2008</b>	<b>-.2176</b>	<b>-.0819</b>	<b>.0772</b>	<b>.005</b>
<b>2010</b>	<b>-.6313</b>	<b>-.2229</b>	<b>.0867</b>	<b>.000</b>



As in the previous regression, we find that females and Blacks continue to show a propensity to underperform compared to the reference variable. In this case, we see that females are about seven percent less likely to attain Honor Graduate eligibility than males, and Blacks are about 12 percent less likely to attain Honor Graduate eligibility than Whites. Both of the lowest ranked institutions are significantly less likely to score an 85 percent or above than the highest ranked institution. All other ship types are significantly less likely to attain Honor Graduate eligibility than DDGs. Every other port, aside from Ingleside, Pascagoula, Little Creek, and Sasebo are much more likely to attain Honor Graduate eligibility than Norfolk. Finally, as in the previous regression, students steadily progressed from 2007 to 2008, but scored lower in 2010 than in 2009.

## **C. INTERPRETATION OF RESULTS FOR BOTH MODELS**

### **1. Gender**

As can be seen from both regressions, females are underperforming on the SWO Fundamentals exam. To more adequately understand these specific regression results, we examine the raw observed data. Of the 478 females in the sample, 128 fail the SWO Fundamentals exam, giving women a 27 percent failure rate. Of the 1443 males in the sample, 306 fail, giving men a 21 percent failure rate. Thus, we see for the sample, that women have a six percent higher failure rate than men. For an overall female failure rate, we divide the failure regression's result of about seven percent by the sample's failure rate of 23 percent and find that females are 32 percent more likely to fail the SWO Fundamental exam than males.

As Bowman, Crawford, and Mehay (2009) and Crawford and Stoker (2010) showed similar findings for females on the SWO Fundamentals exam, it is clear that there is persisting influence acting upon females during the period between commissioning and ASAT. As the factors influencing gender performance inequity are beyond the scope of this thesis, this study suggests simply that we cannot know the specific causal influence for female SWO Fundamental exam underperformance without further study.

## **2. Ethnicity**

Black officers are showing a startlingly significant propensity to both fail and be ineligible for Honor Graduate. Making up 10 percent of the sample, Blacks are nearly 20 percent more likely to fail the SWO Fundamentals exam than Whites. Given the overall failure rate for the sample of 23 percent and the overall HGE rate of 40 percent, Blacks are about 78 percent more likely to fail the exam and 31 percent less likely to attain HG eligibility.

These results are indicative of a significant negative influence upon Blacks during the period between commissioning and ASAT. As with gender, this study will not further speculate on the causal factors behind minority underperformance.

## **3. School Quality**

As Bowman and Mehay (2002) showed in their analysis of officer fleet performance, undergraduate school quality has an impact on an officer's output. In this case, the officer who graduated from the least competitive ranked schools is about 15 percent more likely to fail the SWO Fundamentals exam than the officer who graduated from the most competitive schools. Likewise, those who graduated from the lowest two ranked categories are 18 percent and 19 percent respectively less likely to attain Honor Graduate eligibility than those who graduated from the highest ranked category.

There are two possible reasons for this differential: those students who graduate from the highest ranked categories have been better prepared to learn, and are more receptive to new information than those from the lowest ranked categories; or, those students who graduate from the highest ranked institutions are intrinsically more motivated to learn than their counterparts from the lowest ranked institutions. As this study makes no measure of motivational factors, and in fact, there are far too many varied influences upon a student's motivational levels to be discussed or measured, these regression results should only stand to show that this differential between undergraduate institution categories does indeed exist.

#### **4. Undergraduate Major**

These results, that Engineering majors will outperform all others, specifically the non-technical majors, on the SWO Fundamentals exam, are directly in line with the results from Bowman, Crawford, and Mehay (2009). For this study, Math and Science majors were the only majors not significantly underperforming compared with Engineering majors. As with undergraduate school quality, this could be indicative of intelligence, motivation, or both. As this study makes no measure of motivation, these results should only stand to show that the differential between engineering majors and all others exists.

#### **5. Commissioning Source**

NROTC commissioned officers are about 16 percent more likely to attain Honor Graduate eligibility on the SWO Fundamentals exam than USNA officers. These results show that, while students from USNA are just as likely or unlikely to fail as any other student from another commissioning source, students from NROTC are more likely to excel. One theory explaining this differential, as posed by Crawford and Stoker (2010), seems most likely: USNA graduates are less motivated to undergo and complete either formally instructed or self-paced studies in a practical environment than their conventionally instructed counterparts. Put differently, USNA students were more anxious to hit the deck-plates after four years of military-based training and schoolwork where students from civilian institutes were more capable of taking a measured approach to all requirements levied upon them. However, as these regressions show no indication of any one commissioning source being worse than another in preparing its graduates for the fleet, this study suggests that these results stand only to show that the slight differential between USNA and NROTC for propensity to attain Honor Graduate eligibility exists.

#### **6. Homeport**

Officers stationed in Norfolk are significantly underperforming compared to their counterparts stationed elsewhere. Bowman, Crawford, and Mehay (2009) showed similar

results, with all officers on the Atlantic coast underperforming compared to any officer elsewhere. One theory the researchers posed for the differential was that the operational tempo (OPTEMPO) in Norfolk could be higher than in other homeports. While this study presents no conclusive data regarding OPTEMPO, it suggests that this theory does not appear to be supported, as other homeports, such as Yokosuka, have similar or higher OPTEMPOs than Norfolk. Another theory, posed by Bowman, Crawford, and Mehay (2009) and Roy (2007), is that only officers graduating with the lowest Orders of Merit (OOM) select Norfolk, as it is seen as an “undesirable” homeport and is the last to go at ship selection. As the officers underperformed in their undergraduate institution, so they underperformed in the fleet, with Norfolk as the common link between the two. As with the previous theory, there is no conclusive data regarding homeport desirability; however, the OOM link does appear to have merit and warrants further study.

## **7. Ship Type**

As shown in the results, officers stationed aboard Amphibious type warships and MCMs have a higher propensity to fail the SWO Fundamentals exam than those stationed aboard DDGs. Likewise, those on DDGs are more likely to attain Honor Graduate eligibility than those on any other ship types. The most likely cause of this differential is the difference in both experience and exposure. All officers, regardless of ship type, are required to have robust knowledge of all Navy platform capabilities and limitations. They are expected to know and understand how each ship operates, the nature of its detection and targeting systems, when and how it fires its weapons and how the ship responds to various controls. DDGs offer the officers exposure to each of these situations, providing them with the depth of understanding for the information they are expected to know for their SWO qualification. To be clear, the DDG officer is expected to know the capabilities and limitations of all other warships as well; however, the scope of the qualification is much more centered on systems intrinsic to the DDG than any other ship type.

As with Homeport, another possible cause of this differential could be due to officers with higher OOM selecting the most “desirable” ships. This correlation between college performance and self-selection onto these ships could explain the higher level of performance on the SWO Fundamentals exam. However, as with Homeport, as this study makes no measure of college performance or ship “desirability,” this possible cause should serve only to inform the focus of a future study into CRUDES SWO qualification.

This study suggests that, however impractical, the only real way to resolve the exam differentials between DDG and all other platforms would be to give every officer the same level of exposure to each ship type. A more practical approach, which likewise would not completely equalize the differential, would be to increase the levels of exposure for all officers by allowing for ship visits, officer cruise-swaps and even advanced simulations. Without such allowances for officers to gain experience with the type of equipment and systems found on different platforms, there will continue to be significant differences in levels of knowledge among ship types.

## **8. Class Year**

These regressions show that students tested in 2009 outscored students in 2007, 2008, and 2010. August 2008 saw the shift from SWOS-at-Sea to the current INTRO/ASAT program, and the first students to attend ASAT following the shift arrived in January 2010. With the new program came two significant changes to the officer’s training pipeline: the new instructor-led INTRO course in the first month of an officer’s first tour; and the removal of the Combat Information Center Watch Officer (CICWO) and Officer of the Deck Underway (OOD U/W) qualification requirements as pre-requisites for ASAT attendance.

CICWO and OOD U/W had previously been mandatory qualifications for all officers attending ASAT, which meant that the officers had to apply themselves to a rigorous study and practical application period during the majority of their first tour. They were expected to stand watches, apply themselves with their peers toward the goal of qualification and learn about the various shipboard systems. These requirements could certainly still be enforced on ship-by-ship basis, but their relaxation for attendance to

ASAT means that now that the students have not been boarded for these intensive qualifications, they have not attained the same depth of knowledge and experience that their predecessors had attained. However, without conclusive data pertaining to the relaxation of the qualification requirements, this study can only suggest further research into the effects the lack of CICWO and OOD U/W qualifications have on an officer's performance on the SWO Fundamentals exam.

The other significant change, the instructor-led INTRO course, could also possibly have led to the current SWO Fundamentals exam differentials. For the first month of an officer's tour aboard their first ship, they have been attending classes at their Fleet Concentration Area's (FCA) Afloat Training Group (ATG). When they return to work following completion of the course at the end of that month, they do so with a presumably basic understanding of their duties and the role they are expected to fill. The potential problem arises then with their level of expectation. The question becomes: If I have already been trained, why must I continue to do the self-paced study with the SWOS-at-Sea v3.0 CBTs? The expectation could be from the individual, or even from their chain of command, but either way, the ATG has trained them, so now they must get to work. This misinterpretation and mismanagement of expectation levels could potentially cause the differential evidenced by these regression results. However, as officers continue to cycle through the program, the new curriculum progresses and the fleet's perception of the functionality of the INTRO curriculum matures, the differential will most likely decrease.

#### **D. CHAPTER SUMMARY**

This chapter has shown the results of both model's regressions and has theorized as to the cause for all differentials. The results have largely corroborated those from Bowman, Crawford, and Mehay (2009), and Crawford and Stoker (2010), and show that there are indeed many influences that impact an officer's performance on the SWO Fundamentals exam. Of most concern are the results for gender and ethnicity, but also of

note are the results for homeport, ship type and year. The next chapter discusses overarching recommendations in detail, but most certainly further qualitative study, which at minimum, must be conducted in order to investigate these differentials.

## **V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS**

The preceding chapters have provided background insight into the nature of the SWO training pipeline, discussed the framework for analysis of the SWO Fundamentals exam, and covered the quantitative results from that analysis. This chapter discusses those results as they pertain to each research question and provides recommendations for future studies into these and related research questions.

### **A. SUMMARY**

The research questions directing the focus of this study were:

How are a student's pre-commissioning factors related to their SWO Fundamentals exam scores?

How are a student's professional factors related to their SWO Fundamentals exam scores?

How are students in the INTRO/ASAT pipeline performing on the SWO Fundamentals exam compared to students from the SWOS-at-Sea pipeline?

#### **1. How Are a Student's Pre-Commissioning Factors Related to Their SWO Fundamentals Exam Score?**

Gender, ethnicity, undergraduate school quality, and undergraduate major, play significant roles in determining a student's performance on the SWO Fundamentals exam. Females, blacks, students from the least competitive schools and those with non-engineering degrees show a higher propensity to fail and a lower propensity to attain Honor Graduate eligibility.

#### **2. How Are a Student's Professional Factors Related to Their SWO Fundamentals Exam Score?**

Homeport, ship type, and class year, play significant roles in determining a student's performance on the SWO Fundamentals exam. Officers stationed out of



Norfolk, those assigned to Amphibious type ships and Mine Countermeasure ships and those who attended ASAT in 2010 show a higher propensity to fail and a lower propensity to attain Honor Graduate eligibility.

### **3. How Are Students in the INTRO/ASAT Pipeline Performing on the SWO Fundamentals Exam Compared to Students from the SWOS-at-Sea Pipeline?**

The INTRO/ASAT pipeline started in August 2008. Following a nominal timeline, the first students to attend ASAT after receiving INTRO training were those who arrived at ASAT in January 2010. As shown in the results chapter, students tested in 2010 showed a significantly higher propensity to fail the exam, and a lower propensity to attain Honor Graduate eligibility, than students tested in 2009.

## **B. CONCLUSIONS**

These results have indicated several problem areas in the SWO training pipeline. As the Surface Community as a whole is experiencing a wide array of negative internal influences, many of which discussed in VADM Balisle's Fleet Review Panel of Surface Force Readiness (2010), the added strain of any inadequate training would only compound current and future problems. It is of the utmost importance, therefore, that we fully understand the nature of these quantitative results showing deficient sub-groups in the SWO community and reinforce that understanding with further qualitative study.

### **1. Gender and Ethnicity**

There is a performance gap for gender and ethnicity on the SWO Fundamentals exam; this shows that, during the period between commissioning and ASAT, there exists a negative influence that is manifested in exam scores. Among many possibilities, this influence could exist in the exam itself, in the SWO OJT method, the SWO community at large or in any one of various inherent sociological factors. As such, this performance gap must be investigated and addressed, as it could possibly be indicative of further similar inequities in the SWO community. An investigation into the gender/minority performance gap could provide useful feedback on the Surface Community's mentorship

program. If there exists a negative influence on women and Blacks in the fleet, whether from males or Whites or from intrinsic sociological factors, the best and most efficient way to resolve such influences would be through reshaping and restructuring the nature and focus of the mentorship program.

## **2. School Quality and Undergraduate Major**

Officers who received their undergraduate degrees from the lowest competitive institutions as ranked by the Barrons Selectivity Index are significantly more likely to underperform on the SWO Fundamentals exam than those from the most competitive. Likewise, those with non-engineering degrees are more likely to fail and less likely to attain Honor Graduate eligibility than those with engineering degrees. This is interesting due to the possible influence undergraduate school quality and major could exhibit on an officer's performance in other areas. Further study into these effects could yield data useful for shaping future recruitment and training policies.

## **3. Commissioning Source**

There were no significant differences between NROTC, OCS and USNA for propensity to fail the SWO Fundamentals exam. However, in the HGE model, NROTC showed a 16 percent propensity to score 85 percent or above on the SWO Fundamentals exam when compared to USNA. Given these results, it is evident that officers commissioned from NROTC are at an advantage over USNA graduates during the period between commissioning and ASAT, as measured by the SWO Fundamentals exam. Further study into commissioning sources and their influence on officer fleet and academic performance could provide interesting results that may potentially inform the nature of pre-commissioning training and recruitment.

## **4. Homeport and Ship Type**

Norfolk sailors appear to be severely disadvantaged compared to sailors from Mayport, Yokosuka, Pearl Harbor, Everett and San Diego when they arrive at ASAT. Likewise, DDG sailors are much more likely to outperform all others on the SWO

Fundamentals exam. These results may be due to the types of missions the ships conduct, the OPTEMPO of particular fleets, the nature of quality of life on learning, or the nature of ship selection as related to Order of Merit (OOM).

There have been several studies, such as Bowman, Crawford, and Mehay (2009), Roy (2007) and Bautista (1996), which comment on these factors. One theory they mention, that Norfolk, AMPHIBs and MCMs are the “least desirable” and thus pull the officers with the lowest OOM, seems most likely. As officers are “racked and stacked” by their commissioning sources, due to grades and military performance, and as the lowest ranked officers select their initial tour after the rest of their peers, if it is true that Norfolk and non-CRUDES ships are predominantly selected last, there could be significant indication tying the poor performance of Norfolk and AMPHIB/MCM sailors on the SWO Fundamentals exam with OOM. The important implication here lies in the performance of the officers on their ships. If it is true that in most cases only officers with the lowest undergraduate performance select Norfolk or non-CRUDES ships, then there is significant cause for concern regarding the overall professional performance of those officers. The residual implications of a fleet-wide group of underperforming officers would be staggering. As such, it is necessary that future research be conducted analyzing all aspects of an officer’s professional environment as related to performance; specifically, this study should focus on the nature of ship selection, and the nature of the relationship between selection and undergraduate performance.

For ship-type alone, further qualitative study could reveal shortfalls or negative implications in the SWO training pipeline, such as the following:

- Dedicated research may show that non-DDG officers are not seeing the same types of exercises and may benefit from more extensive simulator training. While simulator training is not optimal when compared to real-world training, it may prove to be the most efficient means of conveyance as there are many types of missions that are simply not seen by officers in the SWO training pipeline.

- It may serve to influence future cruise-swap programs, where officers are temporarily assigned to other deploying ships. This would allow officers to miss extended inport periods on their parent ships in order to take advantage of varying missions and ship exercises. This activity already takes place on a ship-by-ship basis; however, further study informed by the quantitative results from this thesis could highlight the necessity for fleet-wide consideration.

## 5. Class Year

Officers taking the SWO Fundamentals exam after receiving INTRO, are scoring significantly lower than officers who took the exam under the SWOS-at-Sea curriculum. This result could be stemmed from any of the following factors:

- The relaxation of the requirement for officer completion of the CBT discs has removed all incentive to study the requisite material. That CBT was an unpopular requirement is well known; however, if we are going to continue expecting that officers learn the material, it does not make sense to remove the requirement. If the officers are not going to learn the material on their own and individual commands are not going to teach it (both evidenced by this thesis' results), CBT completion should be restored as a requirement for SWO qualification.
- The removal of the requirement for CICWO and OOD U/W qualifications as pre-requisites to ASAT have resulted in reduced level of knowledge upon arrival at ASAT. Officers who have attained CICWO and OOD U/W have sat multiple qualification boards, stood countless underway watches under instruction and have pored over many publications. It stands to reason then that those officers would have a broader grasp of the knowledge required of them upon arrival at ASAT. This possible causal factor warrants further qualitative study. Specifically, the study should focus on the Junior Officer's current level of knowledge upon arrival at ASAT, from both the Junior Officer and Commanding Officer's perspective.

- The addition of INTRO training has resulted in relaxed enforcement of Junior Officer shipboard training. It is possible that officers who have received formal training after commissioning place less importance upon studying publications or reviewing CBT. They may feel that they have already been trained, and so are ready to focus all of their efforts in applying that training. Likewise, the Senior Officers who would have stressed the Junior Officer's training may now feel that Junior Officers should focus their efforts on practical application rather than further study. Any differential effect this possible influence may be causing will decrease over time. As the impact of INTRO training becomes fully realized throughout the fleet, and any lacking areas in Junior Officer training are widely understood, any misconceptions regarding a new officer's level of knowledge will disappear.

## **C. RECOMMENDATIONS**

To better understand the results from this quantitative analysis, and to gain a broader understanding of the influences an officer's background and environment have on professional performance, this study recommends the following:

Conduct research studying ethnicity and gender effects on test scores. The results for gender and ethnicity for both Failure and HGE models raise serious concerns about the SWO community's diversity and mentorship programs. Future qualitative research into these areas would prove beneficial by showing the nature and scope of any existing negative influences.

Conduct research studying homeport and ship type effects on test scores. The implications from this study's negative results for Norfolk and non-CRUDES officers could mean that there exists a significant underperforming portion of the SWO community. Identification and modification of the causal factors of this underperformance could significantly impact and improve the nature of the future of the Surface Community.

Conduct further studies analyzing the various leveling aspects of the INTRO/ASAT curriculum. This study does not measure the possible leveling effect of ASAT on these knowledge differentials. Further quantitative and qualitative research could also serve to inform the results from this thesis, specifically the differential between the SWOS-at-Sea and INTRO/ASAT pipelines. Currently, Bowman and Crawford (2011) are conducting an N1-funded study into these aspects and are analyzing the current curriculum in order to see what effects demographic, pre-commissioning and professional background have on the Navigation, Maritime Warfare and Rules of the Road exams in comparison with the SWO Fundamentals exam.

Conduct a study relating performance on ASAT exams to Junior Officer performance. The results of this study have shown the impact of a Junior Officer's background and environment on his/her performance on the SWO Fundamentals exam. Using SWO qualification dates, Fitness Reports, undergraduate school grades and SAT scores to inform a study into the relationship between performance and ASAT exams, a future study would serve to fully describe the nature and effectiveness of the entire SWO qualification process.

Conduct a study examining performance at Department Head School. A study showing the influences of an officer's background and professional factors between commissioning and DH School would serve to highlight any negative or positive influences on an officer's performance. As the officers in the sample would have passed their initial Military Service Requirement, the results would discuss the impact the choice to stay in the Navy as a SWO has on performance.

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